

Reducing the Amount of Nitrate in Iowa's Waterways



Jed Dettmering
Chemistry and AP Chemistry
Southeast Polk High School
Des Moines Public Works- Stormwater

<p>Part I: General Overview of Business</p> <ul style="list-style-type: none">• Des Moines Public Works has been part of the city for over a century, stormwater is just aspect.• The mission of the Department of Public Works is to operate and maintain infrastructure and provide essential services for everyday life and economic growth.• The Wastewater Reclamation Authority works to protect public health and to enhance the environment by recycling wastewater. They are the preferred treatment facility for hauled liquids wastes.	<p>Part II: Job Specifics</p> <ul style="list-style-type: none">• The job of the stormwater department is to prevent pollution from entering our creeks, rivers, and lakes due to runoff on impervious surfaces.• When it rains, water runs off concrete and asphalt and carries pollutants with it.• If too many of these pollutants enter Iowa's waterways it negatively impacts the wildlife and ultimately reduces the quality of drinking water to residents of Des Moines.• Stormwater is required to test the water to look at the concentrations of many pollutants in the water.• Nitrate is one of those pollutants that gets a lot of attention in Iowa because it is used ubiquitously on farms in Iowa as fertilizer.
<p>Part III: Introduce the Problem</p> <ul style="list-style-type: none">• Our job will be to test a sample of water to determine the concentration of nitrate in the water using spectroscopy and Beer's Law.• We will determine if the concentration of nitrate represent a reasonably safe concentration.• We will also come up with ways to reduce the concentration of nitrate in this waterway that was tested. (What is causing this particular waterway to have high concentration of nitrate?)• How can we prevent the nitrates from entering the waterways?	<p>Part IV: Background</p> <ul style="list-style-type: none">• Students will need to understand concentrations/molarity, stoichiometry, calibration curves, Beer's Law, spectroscopy and laboratory techniques.• Students will need to understand how to name polyatomic ions• The DNR had to develop a way to take measurements of nitrate concentrations in real time in several waterways in Iowa to collect data with an automated system.• The Civil Engineers that work for the City of Des Moines had to develop the best methods for reducing the amount of sediment that enters the stormwater systems.
<p>Part V: Business Solution</p> <ul style="list-style-type: none">• The DNR has put in place remote nitrate testers in water than can give them real time data on nitrate levels. This helps isolate areas where nitrate runoff is high.• Civil engineers put in place many measures to prevent stormwater runoff, such as: retention basins, rain gardens, native landscaping, etc.<ul style="list-style-type: none">• These measures are designed to force water to travel through plants and the ground rather than runoff of roads and into streams. Plants and soil act as natural filtration systems that remove most pollutants from the water before it reaches the streams.• Water works also has a treatment plant to remove pollutants, including nitrate, from water before it is put into circulation.	<p>Part VI: Student Solutions</p> <ul style="list-style-type: none">• Students will have done a lab using Beer's Law and spectroscopy leading into this one so they should be able to come up with the idea of using spectroscopy to create a calibration curve.• Once they have a calibration curve they will be able to determine the concentration of nitrate in the sample of water using the linear relationship.• With research they will come up with any of the following ideas and possibly more<ul style="list-style-type: none">• Reduce the amount of fertilizer used in the farm fields• Using less impervious materials in cities• Green roofs on building in downtown areas (Central Library in Des Moines has one)• Government incentives for the use of rain gardens, rain barrels, native landscaping, etc.• Educating the public on the problem• Writing their politicians so they can actually do something right for a change• They may come up with many more out of the box ideas